

WHAT IS CLAIMED IS:

1. A method of determining tissue densities from computed tomography images, the images containing voxel representations of x-ray attenuation of a subject's body, the method comprising:

acquiring at least one CT image of the subject's body and a calibration phantom simultaneously;

determining a CT measure of at least one region of the phantom;

locating a region of the image containing blood or heart tissue;

determining a CT measure of at least one region located within blood or heart tissue;

combining the CT measures of the phantom and the CT measure of the blood to develop a calibration relationship;

applying the calibration relationship to the image; and

recording a calibrated image.

2. The method of Claim 1 wherein the CT measure is the mode of the histogram of the CT numbers of the region.

3. The method of Claim 1 wherein the CT measure is the mean of the CT numbers of the region.

4. The method of Claim 1 wherein the calibration relationship is a regression equation.

5. The method of Claim 1 wherein the calibrated image contains voxels expressed in density units.

6. A method to calibrate the computed tomography (CT) density of tissues in x-ray computed tomography, the method acquiring at least one image containing voxels representing x-ray attenuation in the tissue, the method comprising:

locating a measurement region in at least one area of the image containing blood;

recording the CT numbers of the region;

determining a reference CT number of blood; and

correcting the image by the relationship between the reference CT number and the measured CT numbers of blood.

7. The method of Claim 6 wherein the tissue is coronary calcium.

8. The method of Claim 6 wherein the tissue is lung.

9. The method of Claim 6 wherein the reference CT number of blood is measured in vitro.

10. A method of determining coronary calcium from computed tomography images, the images containing voxels representing x-ray attenuation of a subject's heart, the method comprising:

acquiring at least one image which includes the heart;

identifying a region of the heart;

determining a CT number measure of at least one voxel in the heart;

identifying at least one region which contains calcium;

determining a CT number measure of the calcium;

correcting at least one image of the heart using the heart CT number measure;

establishing a calcium CT number threshold which is greater than the heart CT number measure; and

determining a calcium measure.

11. The method of Claim 10 wherein the region of the heart is the entire heart.

12. The method of Claim 10 wherein the CT number measure is the mode of a histogram of the CT numbers.

13. The method of Claim 10 wherein the correcting means applies a smoothing algorithm which produces CT slices with mode and histogram distribution equal to the heart CT number measure.

14. The method of Claim 10 wherein the CT number measure is the CT number of a voxel.

15. A method of determining tissue densities from computed tomography images, the images containing voxels representing x-ray attenuation of a subject's body, the method comprising:

- acquiring at least one CT image of the subject's body;
- segmenting a region of the image containing reference tissue;
- determining a CT measure of at least one voxel in the region containing reference tissue;
- correcting the image using at least one CT measure of the reference tissue, and
- recording the corrected image.

16. The method of Claim 15 wherein the reference tissue is subcutaneous fat.

17. The method of Claim 15 wherein the reference tissue is air.

18. The method of Claim 17 wherein the air is air internal to the body.

19. The method of Claim 15 wherein the determining step comprises performing histogram analysis of all voxels after segmentation of the region.

20. A method to quantify calcium in the arteries of human subjects from at least one computed tomography image, the method comprising:

scanning a reference calibration phantom containing calcium simultaneously with the subject;

calibrating at least one image pixel using the calibration phantom;

locating the boundaries of blood or the heart;

determining a CT number measure of voxels within the boundaries;

determining a calibration equation which includes a slope of CT numbers in the calibration phantom and which includes an intercept determined from the CT number measure;

correcting pixels within the image by the calibration equation;

identifying voxels above a threshold value; and

determining calcium within the arteries.

21. The method of Claim 20 wherein the arteries are the coronary arteries.

22. The method of Claim 20 wherein the locating boundaries step uses an edge threshold value which is calibrated.

23. The method of Claim 20 wherein the boundaries are the three-dimensional borders of the heart.

24. The method of Claim 20 wherein the best measure is the mode of the histogram of the CT numbers.

25. A method of displaying an image of a subject, the image containing gray scale pixel values representative of tissue properties of the subject, the method comprising:

imaging a known reference simultaneously with the subject;

calibrating the pixel values of the image with pixel values of the reference;

defining image display gray ranges of window and level, which are known in units of the known reference, the display gray levels being optimized for viewing specific image details; and
displaying the images.

26. The method of Claim 25 wherein the known reference is an external phantom.

27. The method of Claim 25 wherein the known reference is an internal tissue of the subject.

28. The method of Claim 25 wherein the imaging is magnetic resonance imaging.

29. The method of Claim 25 wherein the display gray scale ranges are calibrated HU values.